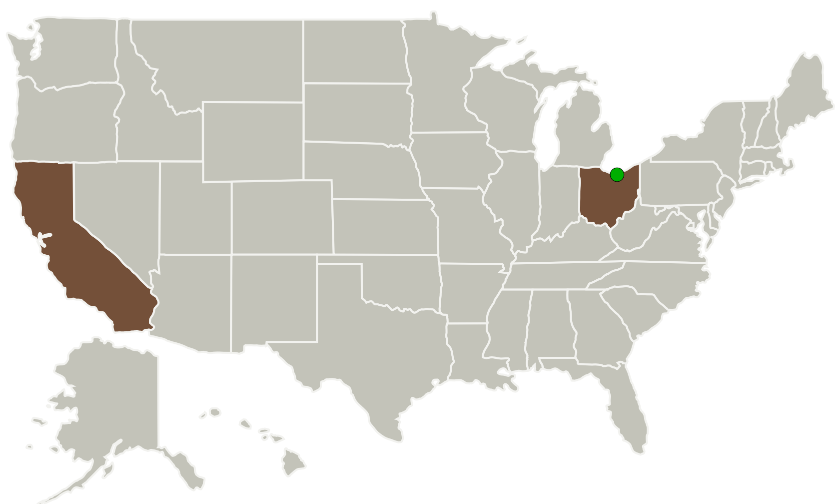
Pulsating Heat Pipes, Phase II

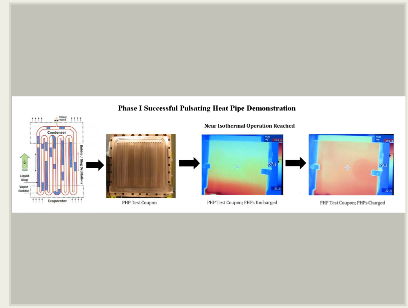
Completed Technology Project (2016 - 2019)

Project Introduction

Large radiator panels, based upon state of the art conventional heat pipes with attached fins for thermal load distribution and dissipation is the current baseline design for NASA's Fission Power System. The initial 1 kWe FPS requires a total radiating surface of 2.5 m2. Higher power designs will require corresponding larger radiating surfaces. In order to achieve optimum radiator performance, the face sheets of these radiators should present waste heat loads as isothermal sheets pointed to the sink of space. The current state of the art designs do not meet this requirement and rely upon heat pipes to axially carry the waste thermal loads while radiating fins, with typical thermal gradients and losses, provide thermal distribution away from the heat pipes via simple conduction. Under Phase I, Peregrine has successfully demonstrated an alternative design which promises to be lower in mass while improving performance based upon pulsating heat pipes (PHPs). PHPs can directly acquire and then readily distribute thermal loads across the face of radiator panels to create highly efficient near isothermal designs. PHPs are an autonomous, self-contained, low profile, lightweight, high performance thermal transport system based upon heat of vaporization. Phase II will characterize a titanium/water pulsating heat pipe system, build prototypes of a Pulsating Heat Pipe (PHP) radiator for a 1 kWe FPS, and also build a conventional heat pipe design in order to provide a side by side comparison of performance increases of PHPs versus the conventional design. Phase II will provide objective data through empirical results for future efficient lightweight, isothermal radiator designs.

Primary U.S. Work Locations and Key Partners





Pulsating Heat Pipes, Phase II

Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

Pulsating Heat Pipes, Phase II

Completed Technology Project (2016 - 2019)

Organizations Performing Work	Role	Type	Location
The Peregrine Falcon Corporation	Lead Organization	Industry	Pleasanton, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

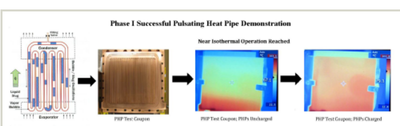
Project Transitions

April 2016: Project Start

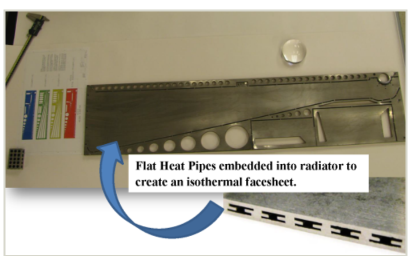
November 2019: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/139804)*

Images



Briefing Chart Image
Pulsating Heat Pipes, Phase II
(https://techport.nasa.gov/image/126833)



Final Summary Chart Image
Pulsating Heat Pipes, Phase II
(https://techport.nasa.gov/image/125814)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
The Peregrine Falcon Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

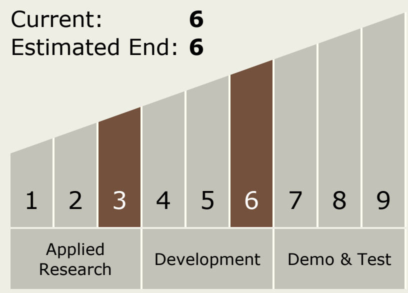
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Robert Hardesty

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - └─ TX03.1 Power Generation and Energy Conversion
    - └─ TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System